

# 2008 WMA Mini-Grant Research Project Proposal

## **Contract Lead Group and Contact Person(s):**

The Regents of the University of California, on behalf of UC Cooperative Extension Fresno County

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## **Project Lead(s) for project and contract reporting and invoicing:**

Principal Investigator	Co-Investigator
UCCE Fresno County	USDA/ARS
Amanda Crump	Bradley D. Hanson
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## **This project is in affiliation with what WMA group or groups?**

Sierra-San Joaquin Noxious Weed Alliance (Fresno, Madera, Mariposa counties)

## **List what other Noxious and Invasive Weed Research has been conducted by you or your group:**

Hanson's research program has focused on weed ecology, biology, and management in several agronomic and non-crop situations. In recent years, specific projects have focused on annual weeds in the soil seed bank, herbicide persistence in annual and perennial crops, yellow starthistle control in rangeland, invasion and spread of glyphosate-resistant horseweed, annual and perennial weed management in fumigated crops, allelopathic effects of spotted knapweed, and genetics and biochemistry of herbicide resistance in wheat and jointed goatgrass.

## **Proposed Project(s)**

**Project Title:** Testing the Effects of Ethylene on Suicidal Germination of Japanese dodder (*Cuscuta japonica* Choisy) Plant Fragments and Seeds.

## **Project Goal (1/2 page max):**

This project is designed to test the effects of ethylene gas on the germination of Japanese dodder (*Cuscuta japonica* Choisy) vegetative fragments and on seed. Our overall goal is to provide basic research on this parasitic weed while giving local and state weed managers a tool to increase efficacy the eradication program and decrease long-term costs.

*C. japonica* is classified as a Class A parasitic noxious weed by the California Department of Food and Agriculture. This species is not native to California and has been detected in thirteen

counties in California since 2004. There are over 150 sites infested with Japanese dodder ranging from Butte to Los Angeles counties including 26 sites in Fresno County. *C. japonica* has a broad host plant range and can parasitize annual plants as well as woody trees and shrubs. *C. japonica* can reproduce via seed or stem fragment. *C. japonica* seeds have not been found on plants in California; therefore, it is assumed that stem fragments are the main means of dispersal in the state.

Japanese dodder is commonly associated with Asian immigrant populations and is generally found in residential areas on a variety of landscape plants. Eradication efforts generally include removing and burning the infested vegetation and removing all dodder fragments from the area. The area is then monitored for several years to ensure that no viable dodder remains.

This project builds on research done in eradication research in witchweed (*Striga* spp.) where ethylene encourages “suicidal germination” by providing germination stimulus when no host plants are present. Stems that do not reach a host die within days of germination. We hypothesize that a similar mechanism may occur in this parasitic weed. If so, ethylene treatment after host removal could be used to flush seed and vegetative fragments from the area. This could increase the efficacy of eradication efforts and substantially reduce monitoring costs. Our initial efforts will focus on greenhouse testing of the ethylene treatments. If these prove successful, we envision field research in the future.

**What are the project’s long-term benefits and/or local, regional or statewide significance (8 sentence Max):**

This project’s long-term benefits and significance is to:

1. provide a method to shorten monitoring time of land that has been recently subject to Japanese dodder eradication that is useful on local, regional, and statewide levels,
2. establish baseline research in ethylene that will be useful for researchers studying parasitic weeds, and
3. provide an eradication method that is inexpensive and effective for *C. japonica* seeds and stem fragments.

**Priority Topic Area Being Addressed (from request for proposal announcement, 8 sentence Max):**

This project addresses Priority Topic #1: Flushing the Seed Bank. While seeds of *C. japonica* are not commonly found in California, the weed reproduces from plant fragments on plants and in the soil. The application of ethylene in witchweed (*Striga* spp.) has been found effective in “suicidal germination” (germination of a parasite without a host plant present). Our hypothesis is that ethylene will work similarly in *C. japonica* causing it to germinate and die when a suitable host is not readily available.

**Please Describe your in-kind contributions toward research project(s) (4 sentence max):**

Dr. Bradley Hanson will supply greenhouse and other experimental space at the San Joaquin Valley Agricultural Sciences Center in Parlier, California and will contribute 3% of his time towards this project. Ms. Crump will contribute 5% her time and oversee the hourly employee hired for this project. Both Principal Investigators will oversee the entire project.

**Project Objectives, Tasks and Methods:**

**OVERALL OBJECTIVE (4 sentence Max):** Determine the effectiveness of applying ethylene to stimulate bud break of stem fragments or germination of seed to reduce residual dodder and shorten the monitoring period during the eradication effort.

**Task 1 (2 sentence Max):**

Determine if Japanese dodder propagules sprout in response to ethylene gas exposure.

**Methods (8 sentence Max)-**

Greenhouse and growth chamber trials will be conducted to determine the effect of several concentrations of ethylene gas on sprouting of Japanese dodder stem fragments. Healthy plant fragments will be incubated in sealed glass containers and will be subjected to a range of ethylene concentrations. After incubation, fragments will be placed in potting media in the presence and absence of suitable host plants and the number and weight of sprouts will be determined. Qualitative data will be collected on the biology and behavior of the treated and untreated dodder fragments.

**Task 2 (2 sentence Max):**

Determine the effects of ethylene gas on germination of Japanese dodder seed.

**Methods (8 sentence Max)-**

If Japanese dodder seed can be obtained, greenhouse and lab research similar to the plant fragment studies will be conducted. Although Japanese dodder has not been shown to produce seed in California, research is needed in the event seed-bearing plants are eventually discovered.

**Task 3 (2 sentence Max):**

Test the effect of ethylene applications in potting media.

**Methods (8 sentence Max)-**

Once an effective ethylene concentration is determined based on the dose-response experiments outlined above, the effects of ethylene on Japanese dodder plant fragments will be tested in soil. Dodder fragments (or seed) will be placed in potting media and field soil in the greenhouse and exposed to ethylene gas. Individual pots will be covered with plastic tarp to retain the gas and ethylene will be injected using a gas-tight syringe. After ethylene exposure, germination of propagules in the presence or absence of a suitable host will be determined.

**Performance Measures:****How will you assess and/or analyze your results (8 sentence Max)?**

All quantitative data will be analyzed using either analysis of variance (ANOVA) or regression techniques as appropriate. Main effects will be determined with ANOVA and means separated using Fisher's Protected LSD test with an alpha value of 5%. The effects of dose and/or time exposure will be analyzed using appropriate linear or non-linear regression techniques with SAS software. If results in these greenhouse and laboratory studies are encouraging, this research project can be expanded beyond this pilot project in future years.

**How will your results be disseminated (4 sentence Max)?**

In addition to standard WMA mini-grant reporting procedures, Dr. Hanson and Ms. Crump will disseminate the information in the form of a flyer to California Weed Control Districts. Additionally, Dr. Hanson and Ms. Crump will present the results of this study at the California Weed Society Annual Meeting.